Individual Variation in the Time Course of Statistical Word Segmentation: An ERP Investigation

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Introduction

\begin{itemize}
  \item Statistical learning occurs implicitly
  \item However, conventional forced-choice explicit tests may not accurately reflect learning (e.g., Romberg & Saffran, 2013).
  \item Although viewed as a key mechanism for language acquisition, statistical language learning abilities vary even in typical adult populations.
  \item Examining neural indices of word identification may give us a better understanding of sensitivity to newly-segmented words, and help quantify individual variation.
  \item The present study measured neural event-related potentials (ERPs) in response to newly learned versus unlearned “words”. We examined the relation between ERP and behavioural responses to newly segmented words following exposure to a novel language.
\end{itemize}

Method

Participants

17 young adult English monolingual; normal hearing/vision

Stimuli

Artificial language

6 tri-syllabic “words”, structured unsegmented stream

\( W/\text{in} \) word transitional probability = 0.3-1.0
(e.g.: Saffran et al., 1997)

Test phase

“Word” from artificial language + Non-word foil
\( W/\text{in} \) word transitional probability of non-word = 0.0

Procedure

\begin{itemize}
  \item Test phase: 36 auditorily presented word versus non-word pairs
    \begin{itemize}
      \item Two-alternative forced-choice (2AFC)
    \end{itemize}
  \item Measured participants’ behavioural responses
  \item Measured ERP response to words versus non-words, time-locked to stimulus onset
\end{itemize}

Results

\begin{itemize}
  \item 75-150ms after word onset
    \begin{itemize}
      \item Higher peak amplitude for word versus non-word at test over middle frontal and central midline electrode sites (F3, F5, C3, CP1, Pz, FC2, and F4; marginally different over FC6 and C2)
    \end{itemize}
  \item Correlation of behavioural and ERP responses
    \begin{itemize}
      \item 2AFC scores correlated with difference in peak amplitude for word minus non-word evoked responses only for above-chance learners (black), but not when below-chance learners (purple) are included
      \item \( r = -0.491 \) vs. \( r = -0.137 \)
    \end{itemize}
\end{itemize}

Conclusions

\begin{itemize}
  \item ERPs differentiated newly-segmented words from non-words
    \begin{itemize}
      \item Enhanced N100 in response to “word” onset (Sanders et al., 2003)
      \item May index of word segmentation (Sanders et al., 2002)
    \end{itemize}
  \item Significant correlation between magnitude of the ERP effect and behavioural outcome measure
  \item Demonstrates a relationship between implicit and explicit measures of statistical word segmentation
  \item Effect was not present when below-chance performers were included
  \item May reflect inaccurate segmentation strategies adopted by below-chance performers
  \item Successful word segmentation was reflected by both an explicit behavioural test and implicit measures of neural responding
\end{itemize}

References


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